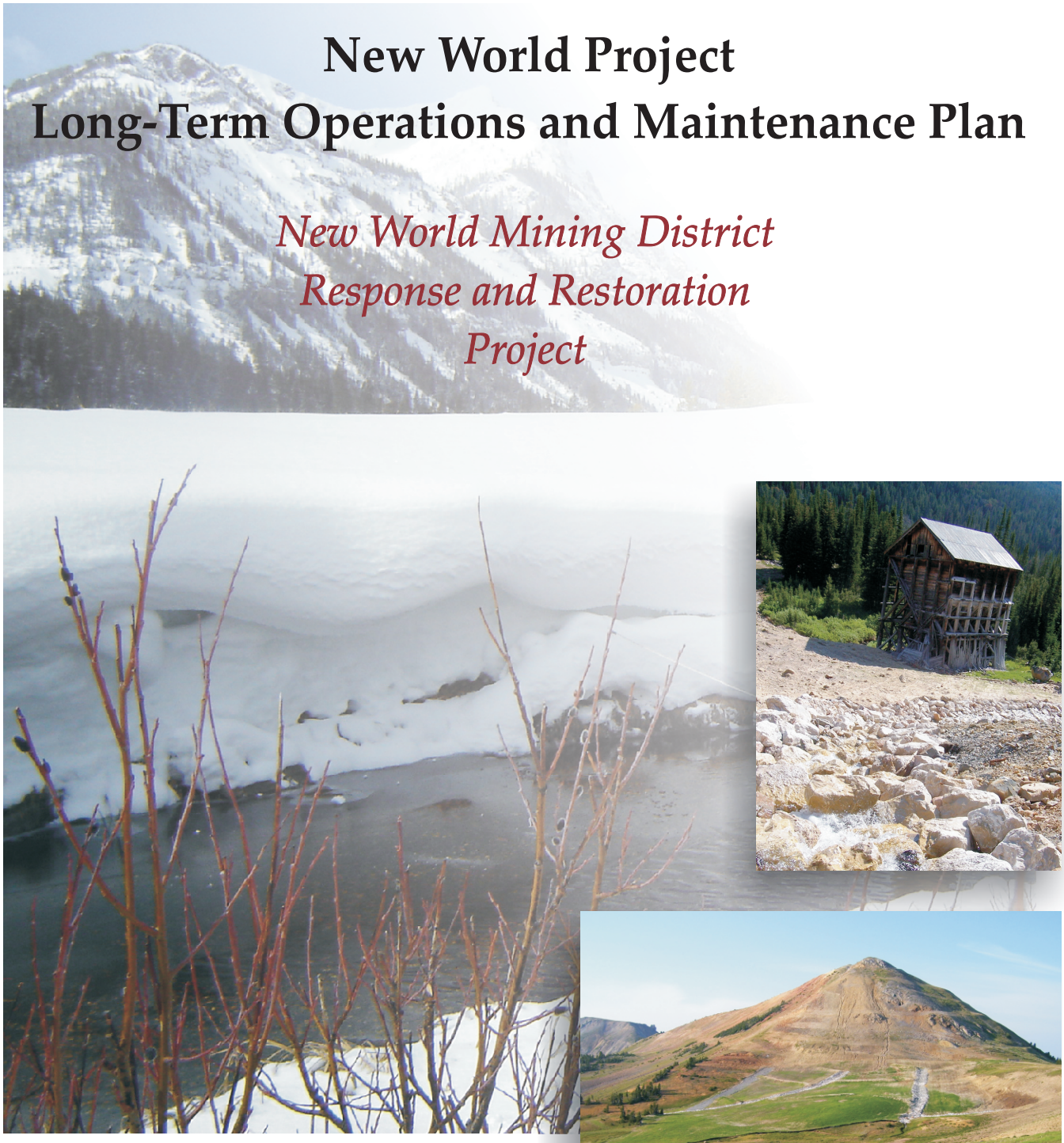
New World Project
Long-Term Operations and Maintenance Plan

New World Mining District Response and Restoration Project



June 2012

United States Department of Agriculture
Forest Service
Gallatin National Forest

TETRA TECH

SITE-WIDE, LONG-TERM OPERATIONS AND MAINTENANCE PLAN
NEW WORLD MINING DISTRICT
RESPONSE AND RESTORATION PROJECT

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June 2012

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1.0 INTRODUCTION

Tasks completed in conjunction with response and restoration activities for the New World Mining District Response and Restoration Project in Park County, Montana (**Figure 1**) are described in the 1999, 2000, 2001, 2002/2003, 2003/2004, 2004/2005, 2005/2006, 2006/2007, 2007/2008, 2008/2009, and 2009/2010 Work Plans (Maxim, 1999b; 2000; 2001a; 2002a; 2003a; 2004a; 2005a; 2006a; Tetra Tech 2007a, 2008a, and 2009a).

The Site-Wide, Long-Term Operations and Maintenance Plan described below provides descriptions of annual monitoring tasks that will be completed to determine whether additional maintenance of reclaimed sites and the repository is needed, how maintenance work will be done, and estimated costs of site-wide monitoring and maintenance. This long-term operations and maintenance plan for the project begins after reclamation actions are complete and covers activities that will occur for the following 20 years. It is estimated the operations and maintenance period will begin in 2012 and end in 2032. This Plan is intended to modify the Overall Work Plan (Maxim, 1999a), and the Repository Monitoring Plan (Maxim, 2006c) during the years of its implementation.

A general description of the site, project objectives, and project organization are provided in this introductory section. Following this introductory section is a detailed description of the operations and maintenance activities that will be completed, a project schedule, and project deliverables. For more detailed descriptions of the overall project, the reader can refer to the Overall Project Work Plan (Maxim, 1999a) and/or annual project summary documents produced in 2001 through 2008 (Maxim, 2001b; 2002b; 2003b, 2004b; 2005b; 2006b; Tetra Tech, 2007b and 2008b). These documents are available on the project website at,

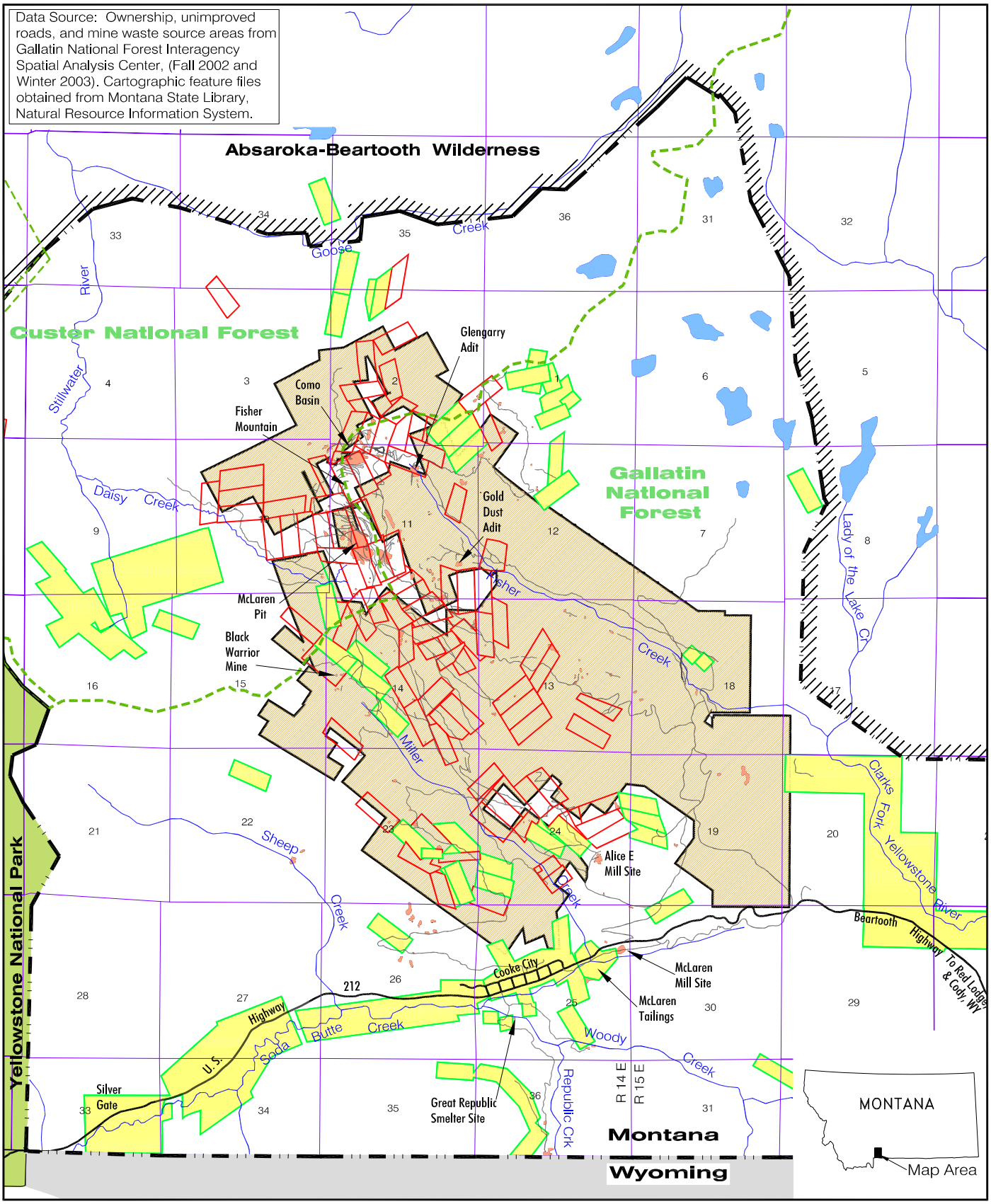
http://www.fs.fed.us/r1/gallatin

and at two project information repositories located at the Gallatin National Forest Supervisor's Office in Bozeman, Montana and at the Cooke City Chamber of Commerce office in Cooke City, Montana. The reader is encouraged to review these documents to gain a better understanding of the overall project.

1.1 PROJECT BACKGROUND

On August 12, 1996, the United States signed a Settlement Agreement (Agreement) with Crown Butte Mines, Inc. (CBMI) to purchase CBMI's interest in their New World Mining District (District) holdings. This transfer of property to the U.S. government effectively ended CBMI's proposed mine development plans and provided $22.5 million to cleanup historic mining impacts in the District. In June 1998, all interested parties and CBMI signed a Consent Decree (Decree). The Decree, approved by the United States District Court, finalized the terms of the Agreement and made available the funds that are being used for mine cleanup. Monies available for cleanup are to be spent first on District Property, which, as defined in the Decree, includes all property or interests in property that CBMI relinquished to the United States (**Figure 1**). If funds are available after District Property is cleaned up to the satisfaction of the United States, other mining disturbances in the District may be addressed.

The USDA Forest Service, as the lead agency responsible for implementing the cleanup, has assembled a management team and has published objectives to guide reclamation and restoration of the historic mining impacts in the District. Under their Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) authority, the USDA Forest Service will execute the response and restoration project by following guidance provided by the Environmental Protection Agency (EPA) for non-time-critical removal actions (EPA, 1993). Non-time-critical removal actions are defined by CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as actions



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New World Mining District Boundary
District Property Boundary
Wilderness Boundary
Unimproved Road
National Forest Boundary
Mine Waste Source Area
District Property (Patented Claims)
District Property (Unpatented Claims)
Private Property

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Project Vicinity Map
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 1

that are implemented by the lead agency to respond to "the cleanup or removal of released hazardous substances from the environment … as may be necessary to prevent, minimize, or mitigate damage to the public health or welfare or to the environment…" (EPA, 1993).

In 1995, EPA began a site investigation after initial announcement of the property transfer from CBMI. The EPA investigation involved installation of monitoring wells, surface water sampling, groundwater monitoring, and completion of a groundwater tracer study. In October 1998, the USDA Forest Service assisted CBMI in completing and submitting a Support Document and Implementation Plan to support the CBMI petition for temporary modification of water quality standards. Under the Decree and Agreement, CBMI was required to submit petitions regarding temporary standards if requested by the USDA Forest Service. The Support Document and Implementation Plan (Stanley and Maxim, 1998) was submitted to the State of Montana Board of Environmental Review (BER) on January 22, 1999. The petition for the adoption of temporary standards for Fisher Creek, Daisy Creek, and a portion of the upper Stillwater River was accepted by the BER and noticed for public hearing. The proposed rule was modified to reflect public comment and the temporary water quality standards were approved and adopted by the BER on June 4, 1999. The objective of the temporary standards program is to provide site specific temporary water quality standards along specified stream segments that are to be maintained, while allowing the project to implement various reclamation activities within the drainages. The temporary standards program envisions that as these reclamation activities are implemented in the affected stream segments (in this case portions of Fisher Creek, Daisy Creek, and the Stillwater River) water quality will improve to the point where these streams meet beneficial uses for waters classified B-1 under the classification standards established by the State of Montana.

In March 1999, the USDA Forest Service initiated the planning process for the project. Planning documents were in place in June 1999, and work began on the project with the monitoring of surface water and groundwater quality at selected monitoring points. All major reclamation work was completed by 2008 and additional road stabilization work was completed in 2011.

Site Location and Description

The New World Mining District falls within the Gallatin and Custer National Forests and lies adjacent to Yellowstone National Park's northeast corner. The Absaroka-Beartooth Wilderness Area bounds the District to the north and east, with the Montana-Wyoming state line forming the southern boundary of the District. The District lies entirely within Park County, Montana (**Figure 1**).

The communities of Cooke City and Silver Gate, Montana, are the only population centers near the District. The neighboring communities of Mammoth, Wyoming, and Gardiner, Montana, are located about 80 kilometers (50 miles) to the west. Red Lodge, Montana, is located about 105 kilometers (65 miles) to the northeast via the Beartooth Highway, and Cody, Wyoming, is located 95 kilometers (60 miles) to the southeast.

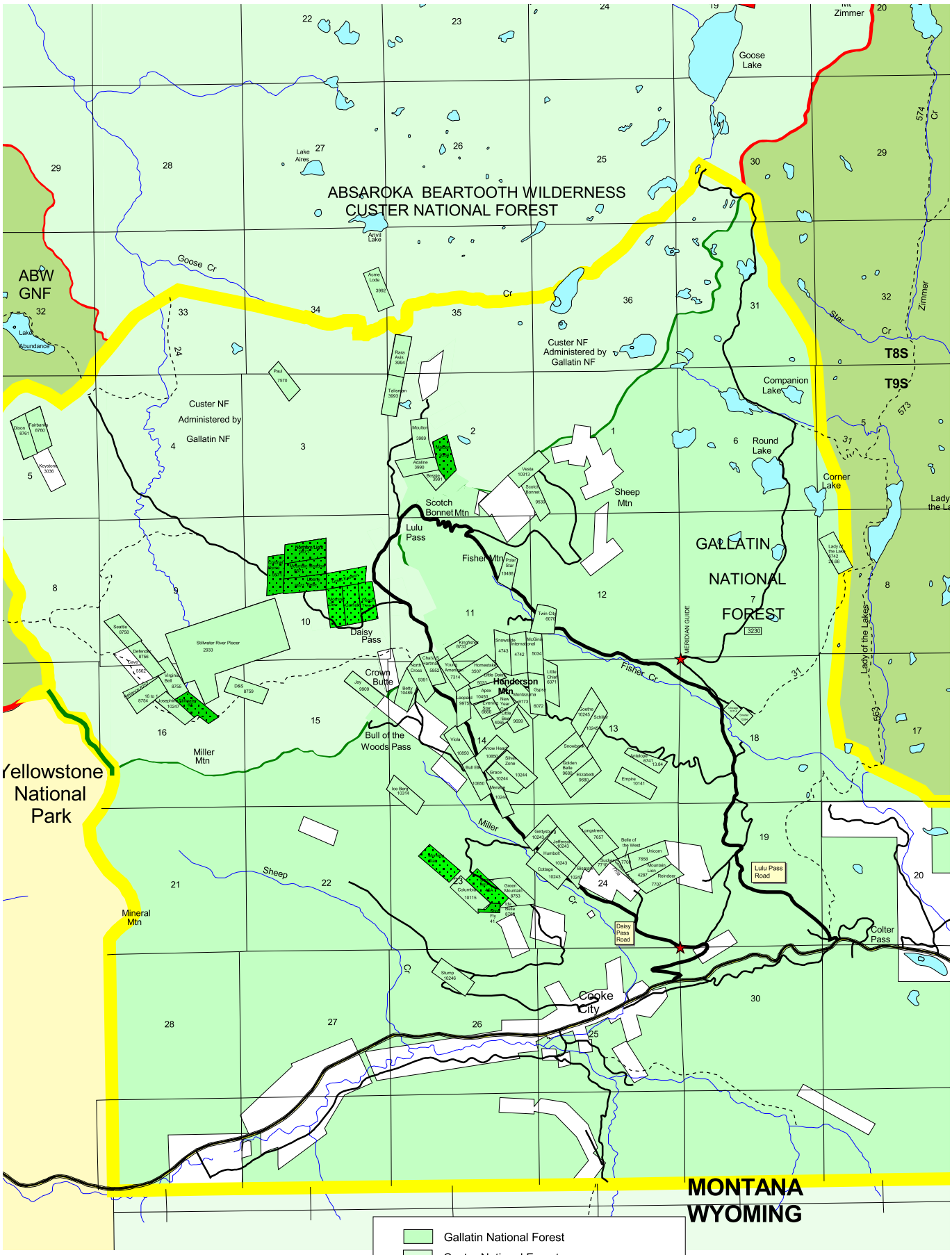
The District is located at an elevation that ranges from 2,400 meters (7,900 feet) to over 3,170 meters (10,400 feet) above sea level. The site is snow-covered for much of the year and only one route of travel is open on a year-round basis -- the highway between Mammoth and Cooke City. The Sunlight Basin road accesses the District from northwestern Wyoming during the spring, summer, and fall but only allows access to within a few miles of the District in winter. The Beartooth Highway allows access to the District from the east but is closed during winter.

The District covers an area of about 10,360 hectares (25,600 acres). Historic mining disturbances and contaminated metal source areas affect about 20 hectares (50 acres) located on District Property (**Figure 1**). Mining disturbances on non-District Property include the McLaren Tailings (**Figure 1**) and McLaren Millsite, which cover an additional 6.9 hectares (17 acres). Federal acquisition of the Reeb Estate land holdings in 2009 has resulted in private land parcels becoming National Forest System lands and changed the land ownership throughout the District. (**Figure 2**).

The topography of the District is mountainous with prominent glacial erosional and depositional features, and is situated at the headwaters of three river systems that all flow into the Yellowstone River. The three tributaries are the Clarks Fork of the Yellowstone, the Stillwater, and the Lamar. The Lamar River flows through Yellowstone Park. The major tributary streams in the District include Daisy, Miller, Fisher, Goose, Sheep, Lady of the Lake, Republic, Woody, and Soda Butte creeks.

1.2 PURPOSE AND OBJECTIVES

The primary purpose of this plan is to guide project activities that will be conducted for the remaining 20 years of operations and maintenance in the District. Sampling and analysis protocols and overall objectives for the Long-Term Operations and Maintenance Plan are consistent with those detailed in the Overall Project Work Plan (Maxim, 1999a) and those described in the Revised Support Document and Implementation Plan for Temporary Water Quality Standards (Maxim, 2003c). However, the actual number of sites to be sampled is different. Primary objectives for work covered in the Long-Term Operations and Maintenance Plan are to document and monitor the effectiveness of reclamation response and restoration actions; to provide for maintenance actions as required to ensure long-term stability of the waste repository, surface drainage diversion channels, other erosion control features, and reclamation covers; to monitor surface and groundwater quality and to satisfy the requirements of the rule allowing adoption of temporary water quality standards. This Plan also provides an outline of specific tasks that form the basis for estimating costs for long-term operations, monitoring and maintenance tasks. This plan is not static and may be modified as needs arise due to changing site conditions (i.e. fire, seismic events, etc) or decisions made after the initial release of this report.



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Gallatin National Forest
Custer National Forest
Patented Claims - Other Private Ownership
US and Other Private Ownership
Absaroka Beartooth Wilderness
New World Mining Withdrawal
National Forest Boundary

prepared by: Gallatin National Forest/jsr **November 4, 2011**

New World Mining District
Land Status After
Reeb Estate Acquisitions
Cooke City Area, Montana

FIGURE 2

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2.0 SCOPE OF WORK

To meet the objectives for the Site-Wide, Long-Term Operations and Maintenance Plan, the following activities will be performed:

- Maintain community relations. Public meetings will no longer be held annually in both Bozeman and Cooke City. It is anticipated that up to two meetings will be held annually.
- Maintain the project database.
- Continue monitoring surface water and groundwater quality in the District as required by the BER for verification that temporary water quality standards are being met.
- Continue monitoring surface water and groundwater quality in the District, including monitoring surface water and groundwater conditions downstream of the Como Basin capped reclamation area, downstream of the closed Glengarry Adit, and downstream and within the capped McLaren Pit. In connection with this monitoring, the USFS will continue to work with the State to determine the actions necessary to support an administrative wrap-up of the temporary water quality standards and the project, such as site specific standards if necessary or other resolution.
- Continue to monitor the New World Waste Repository at select groundwater locations. Solution accumulating within the Repository will be pumped as necessary and is estimated to occur once a year. The continuous water-level meter installed in the repository sump will be replaced as needed however meters installed in other wells will only be replaced on a to-be-determined basis.
- Monitor erosion and vegetation at all reclamation sites every 5 years.
- Prepare abbreviated annual reports that summarize the work that was completed, present data gathered, and delineate the work that will be performed the following year.

This scope of work assumes that all previously monitored surface water and groundwater stations will continue to be monitored through 2011. However, beginning in 2012 and continuing through 2032, the number of surface and groundwater quality stations will be reduced to those described below in this Site-Wide, Long-Term Operations and Maintenance Plan. The decision to remove other stations from the monitoring schedule may be warranted at some point during the long-term operations and maintenance period.

This plan also assumes that contractors would perform all work; however, costs estimated below are based on contractor fees that include estimated costs for USFS oversight.

A more complete description of each of these activities is presented below.

2.1 COMMUNITY RELATIONS

A Community Relations Plan was developed for the project and is included in the Overall Project Work Plan (Maxim, 1999c). This plan describes community relation strategies used to share information with the public and obtain timely input on proposed project activities during the response the restoration project.

Community relations will be modified during the long-term operations and maintenance period to allow up to two meetings to be held every year. At these meetings, summary monitoring data and results will

be presented, and the meeting facilitated by a USFS representative. It is envisioned that this meeting could take place in the field during some years if desired by the participants.

2.2 MAINTAIN PROJECT DATABASE

Environmental data that have been collected at the New World site are cataloged in a Microsoft Access® database, and this database will continue to be updated as new project information is collected each year. Data contained in this database were previously available for downloading from a project website; however, that website would not be maintained during the long-term operations and maintenance period. Instead, database queries or copies of the database would be available on compact disc from the USFS by request.

2.3 SURFACE WATER QUALITY MONITORING

All parameters from previously monitored surface water and groundwater stations as delineated in the 2009-2010 Work Plan (Tetra Tech 2009a) have been monitored through 2011. This provides a five year period (2007 through 2011) of detailed, district-wide sampling in order to gauge the effectiveness of implemented response actions at the project site. This five year period may also allow the evaluation of effectiveness over a range of wet, dry and normal precipitation years. If additional response actions are taken in the future, more detailed and frequent down-gradient sampling of surface and/or groundwater may be desirable to monitor their effectiveness.

This section of the Site Wide, Long-Term Operations and Maintenance Plan describes long-term surface water monitoring activities that will be completed each year from 2012 through 2032.

The decision to remove other stations from the long-term monitoring schedule may be warranted at some point during the long-term operations and maintenance period.

2.3.1 Long-Term Surface Water Quality Monitoring

Surface water quality monitoring will be conducted each year at 10 of the 12 sampling stations identified in the Long-Term Surface Water Quality Monitoring Plan (Maxim, 1999d) plus two additional sites that were not in the long term plan. These stations include the seven stations required for monitoring for compliance with temporary water quality standards (**Table 1**) (Stanley and Maxim 1998; and Maxim 2003c). Stations SW-2 in Miller Creek and SBC-102, in Soda Butte Creek at the west end of the town of Cooke City would no longer be monitored. Sites FCT-11 on a tributary of Fisher Creek draining the Como Basin area, and DCT-8 below the McLaren pit will be added. Sampling sites for surface water during the Long-term Operations and Maintenance period (2012-2032) are shown on **Figure 3** and listed in **Table 1**. Samples will be collected twice per year, once during higher flow conditions in the spring (June/July), and once during low flow conditions in the fall (September/October).

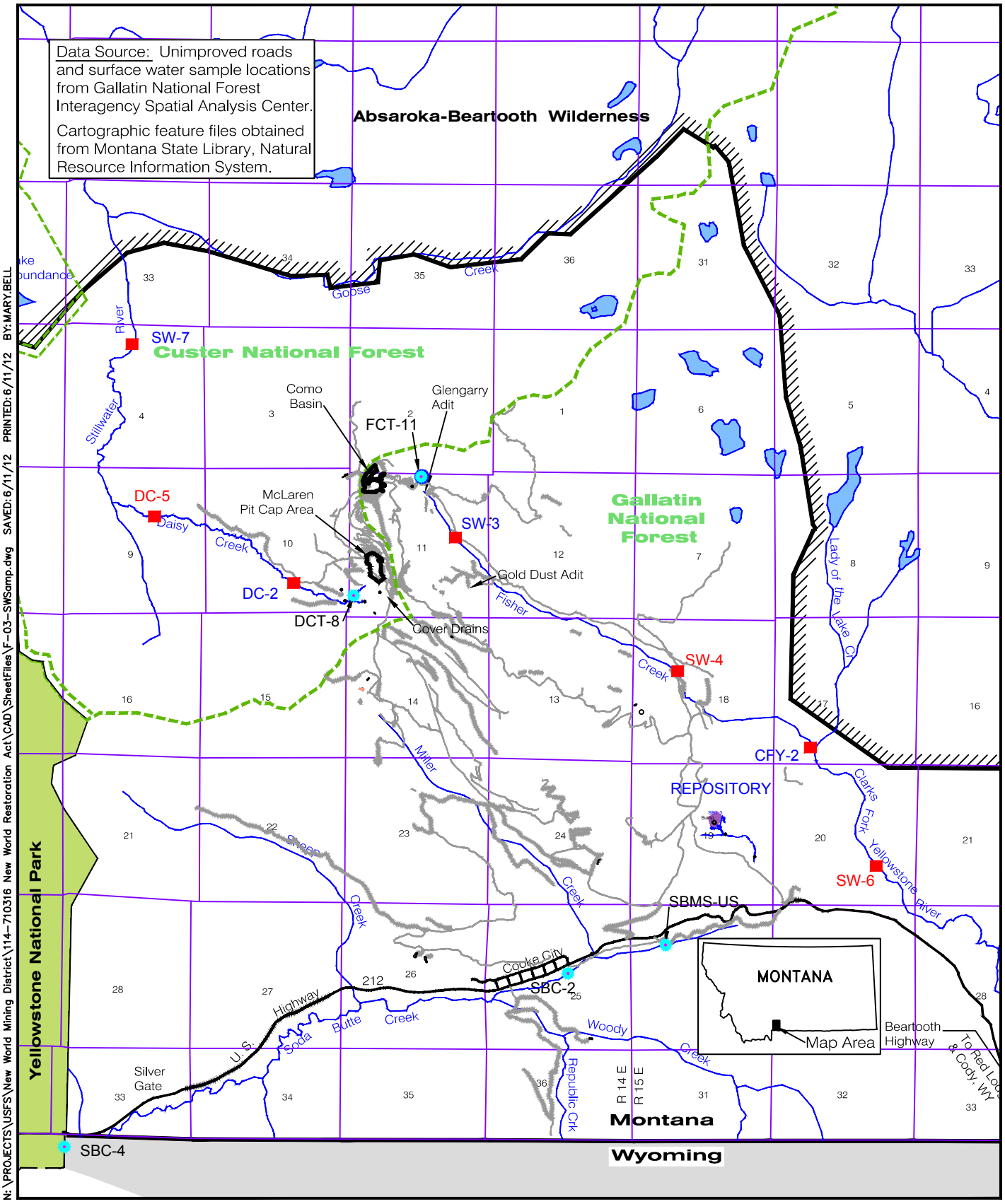
Surface water samples would be collected and analyzed in accordance with procedures and methods described in the Site-Wide Sampling and Analysis Plan (SAP) (Maxim, 1999f). In addition to the analytical methods described in the Site-Wide SAP, analysis of dissolved metals would be added to the parameter list for all sites (**Table 1**). Analysis of dissolved metals will allow further evaluation of reclamation success, particularly below the McLaren Pit and Como Basin areas, as dissolved metals analysis removes the contribution of metals present in suspended sediment.

Table 2 lists surface water field parameters and standard operating procedures (SOPs) from the Site-Wide SAP. **Table 3** lists preservation and bottle requirements and **Table 4** lists surface water analytical requirements and practical quantification limits (PQLs).

TABLE 1
SURFACE WATER SAMPLE SITES
Long-term Operations and Maintenance Plan

Site Name	Location	Monitoring Objective
Daisy Creek Drainage		
DCT-8	Daisy Cr. tributary south of McLaren Pit	Measures contribution of impacts from McLaren capped area to Daisy Creek.
DC-2*	Daisy Creek below confluence of McLaren tributaries	Temporary water quality standard required monitoring station.
DC-5*	Daisy Creek above confluence with Stillwater River	Temporary water quality standard required monitoring station
SW-7*	Stillwater River at Stillwater Trail Crossing	Temporary water quality standard required monitoring station
Fisher Creek Drainage		
FCT-11	Tributary below Como Basin	Measures contribution of impacts from Como Basin capped area to Fisher Creek
SW-3*	Fisher Creek below former Glengarry Adit	Temporary water quality standard required monitoring station
SW-4*	Fisher Creek at Lulu Pass Road Crossing	Temporary water quality standard required monitoring station
CFY-2*	Fisher Creek above Clarks Fork confluence	Temporary water quality standard required monitoring station
Clarks Fork River Drainage		
SW-6*	Clarks Fork Yellowstone River at Saw Mill Road	Temporary water quality standard required monitoring station
Soda Butte Creek Drainage		
SBMS-US	Soda Butte Creek above confluence with Miller Creek	Measures water quality in Soda Butte Creek above McLaren tailings and mill-site, and above junction with Miller Creek.
SBC-2	Soda Butte Creek below McLaren Tailings	Measures water quality in Soda Butte Creek below McLaren tailings and mill-site, and below junction with Miller Creek.
SBC-4	Soda Butte Creek at Park Boundary	Measures water quality at the Park Boundary

* Indicates stations required for temporary water quality sampling by BER.



New World Mining District Boundary
Unimproved Road
National Forest Boundary
Wilderness Boundary
Long-Term Monitoring Station
Long-Term Monitoring Station for Temporary Standards Review (Monitored every 3 years)

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Surface Water Monitoring Stations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 3

TABLE 2
SURFACE WATER FIELD PARAMETERS
Long-Term Operations and Maintenance Plan

Parameter	SOP Number[1]	SOP Title	Event
Specific Conductance	SOP-05	Field Measurement of Specific Conductance	All
pH	SOP-06	Field Measurement of pH	All
Water Temperature	SOP-07	Field Measurement of Water Temperature	All
Flow	SOP-01	Stream Flow Measurement; Wading Technique	All

[1] Maxim Standard Operating Procedures (Appendix A, Site-Wide SAP)

TABLE 3
SURFACE WATER SAMPLING REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	Preservation[1]	Bottle Size/Type
Total Recoverable Metals	HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Dissolved Metals	Filtered through 0.45 micron filter; HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Common Ions/Physicochemical	Iced to 4°C	500 milliliter polyethylene

[1] HNO_3 = nitric acid

TABLE 4
SURFACE WATER ANALYTICAL REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	PQL (mg/L)[1]	EPA Method No.	Max. Holding Time
Physicochemical			
Specific Conductivity	None	2310B	28 days
pH	None	150.1	Upon arrival at lab
Total Dissolved Solids	None	2340C	7 days
Total Suspended Solids	None	160.2	7 days
Hardness	None	2340B	6 months
Acidity	None	305.1	14 days
Metals[2]			
Aluminum	0.05	200.8/200.7	6 months
Cadmium	0.0001	200.8/200.7	6 months
Copper	0.001	200.8/200.7	6 months
Iron	0.01	200.8/200.7	6 months
Lead	0.001	200.8/200.7	6 months
Manganese	0.003	200.8/200.7	6 months
Zinc	0.01	200.8/200.7	6 months
Common Cations[2]			
Calcium	1.0	200.8/200.7	6 months
Magnesium	1.0	200.8/200.7	6 months
Potassium	1.0	200.8/200.7	6 months
Sodium	1.0	200.8/200.7	6 months
Common Anions[2]			
Sulfate	None	375.2	28 Days
Bicarbonate	None	2320B	14 Days
Carbonate	None	2320B	14 Days
Chloride	None	325.3	28 Days

[1]PQL = Practical Quantitation Limit in milligrams per liter (mg/L)
[2]Surface water parameters will be analyzed for total recoverable (unfiltered) and for dissolved metals for all stations;

2.4 GROUNDWATER QUALITY MONITORING

Groundwater monitoring will be conducted during the long-term operations and maintenance period at the wells listed in **Table 5**. Well locations are shown on **Figures 4** through **7**. As with surface water monitoring stations, all previously monitored groundwater stations were monitored through 2011 as described in the 2009-2010 Work Plan (Tetra Tech 2009a). During the long-term maintenance and operations period (2012-2032) the groundwater wells listed on Table 5 would be sampled in July for a full suite of field and laboratory parameters (**Tables 6**, **7**, and **8**).

The decision to remove certain wells from the monitoring schedule may be warranted at some point during the long-term maintenance and operations period. It should be noted that some previously monitored wells were abandoned during 2006 and are no longer available for future monitoring. A list of these wells is included in **Appendix A**.

Groundwater monitoring activities are discussed in the following subsections.

2.4.1 Fisher Creek Groundwater Monitoring

Wells scheduled for the long-term operations and maintenance plan monitoring would be monitored one time each year in July (**Table 5**). These wells have generally been monitored annually since their installation. Monitoring will be conducted in July when water levels at the higher elevation sites are typically at the highest level reached during the year. Past experience has shown that water quality is generally more mineralized and contains higher concentrations of contaminants during this high water level period.

The July groundwater monitoring event would involve measuring water levels, measuring field parameters and collecting samples for laboratory analysis. **Table 6** lists field parameters that will be measured and **Tables 7 and 8** list groundwater analytical parameters and practical quantification limits (PQLs).

McLaren Pit Groundwater Monitoring

Monitoring as part of the long-term operations and maintenance program would be conducted in the Daisy Creek / McLaren Pit area by sampling the wells listed in **Table 5**. These wells are sampled to monitor changes in groundwater conditions that may result from the capping of the McLaren Pit waste rock, which was completed in 2003. McLaren Pit wells would be monitored in July, when water levels are at or near seasonal highs.

Monitoring would consist of measuring water levels, measuring field parameters (**Table 6**), and collecting samples for laboratory analysis in July. Groundwater samples would be submitted to an analytical laboratory for analysis of parameters listed in **Tables 7** and **8**.

2.4.2 New World Repository Monitoring

Groundwater monitoring would be conducted at a select subset of wells at the New World waste repository in accordance with the methods and procedures described in the New World Waste Repository Long-Term Monitoring Plan (Maxim, 2006c). Groundwater monitoring also includes measuring depth to water in the repository sump.

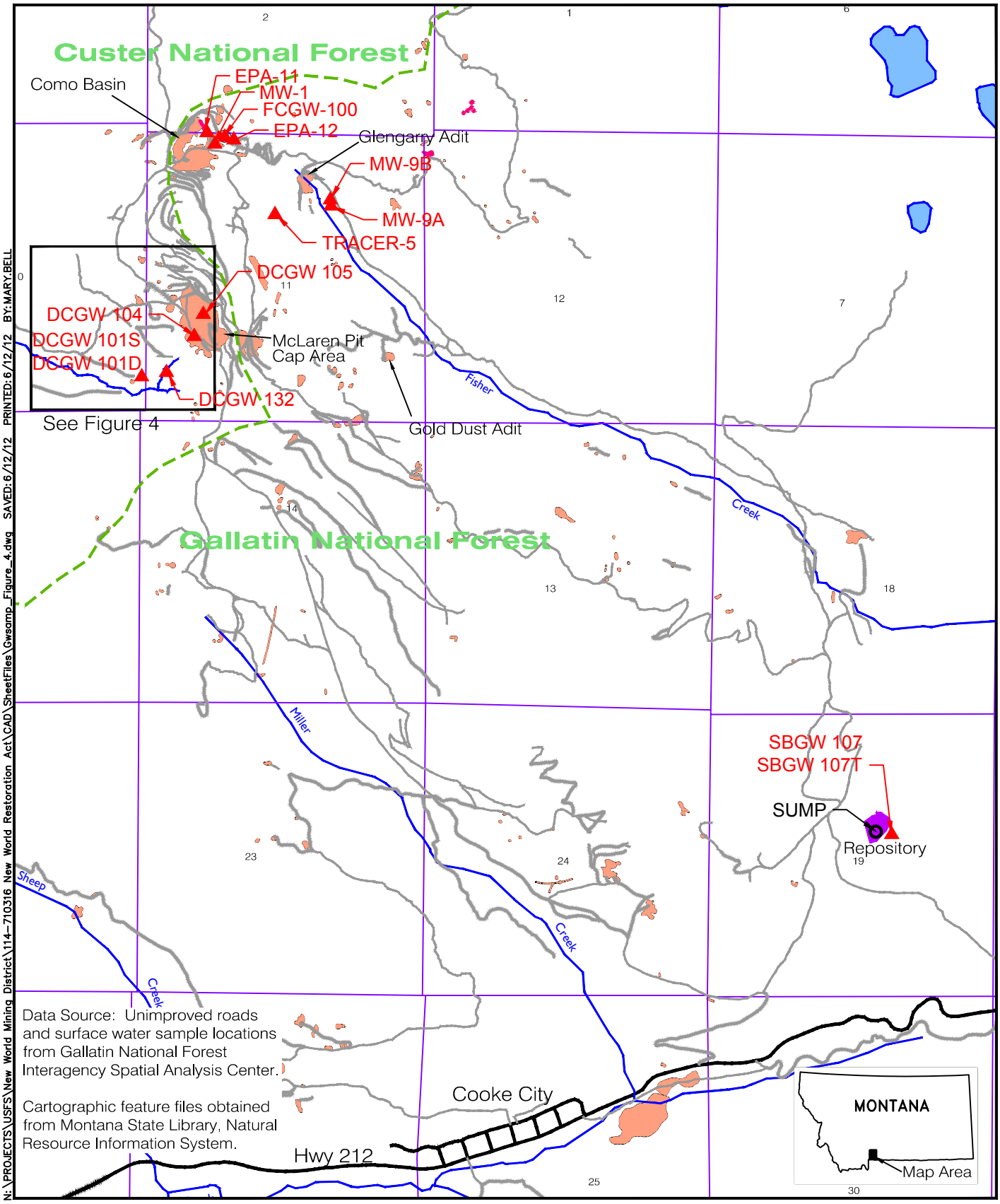
Groundwater monitoring will be conducted at one well pair location (SBGW-107, and -107T) and include maintaining and downloading water level data from the continuous water level measuring instrument installed in well SBGW-107T and collecting water quality samples. Well locations are shown on **Figure 4**. Repository wells will be sampled once per year, preferably when water levels are at the highest level reached during the year. However, repository wells will be sampled concurrently with other monitoring and a separate event will not be scheduled solely for the purpose of monitoring repository wells during high groundwater conditions. Groundwater samples will be submitted to an analytical laboratory for analysis of parameters listed in **Table 8**.

Monitoring would also include maintaining and downloading water level data from the continuous water level instrument installed in the repository sump. If the sump fills to capacity with water, water in the sump will be pumped into water trucks and disposed of at the Cody, Wyoming, sewage treatment ponds. It is assumed that the sump will initially only need to be pumped once per year and that this would typically take place in September or October of the year. Prior to pumping, a sample will be collected from the sump for analysis of surface water quality parameters listed in **Table 4**. Sump water samples will not be collected for water quality analysis at other times when pumping does not occur. It is also assumed that water accumulation in the sump will stabilize at a relatively low rate and may cease altogether as drain down from the encapsulated waste becomes complete. Options for passive treatment of the sump fluid will be considered when monitoring indicates that such a disposal method is feasible based on sump accumulation rates. This would eliminate the need to transport sump fluid for off-site disposal.

TABLE 5
GROUNDWATER MONITORING WELLS
Long-Term Operations and Maintenance Plan

Well No.	Year Installed	Completion Formation	Monitoring Event		
			July	Sept	Continuous
Daisy Creek / McLaren Area					
DCGW-101S	2001	Colluvium	**X**	__	__
DCGW-101D	2001	Lulu Pass Rhyodacite Porphyry	**X**	__	__
DCGW-104	2001	Waste Rock	**X**	__	**W**
DCGW-105	2001	Waste Rock	**X**	__	**W**
DCGW-132	2002	Colluvium	**X**	__	__
Fisher Creek Area					
EPA-11	1996	Tertiary Intrusive Dike	**X**		
EPA-12	1996	Scotch Bonnet Diorite	**X**		
FCGW-100	2004	Glengarry Adit Workings	**X**		
MW-1	1989	Wolsey Shale	**X**	__	—
MW-9A	1990	Alluvium	**X**	__	—
MW-9B	1990	Precambrian	**X**	__	—
Tracer-5	1997	Fisher Mountain Intrusive	**X**	__	—
New World Waste Repository					
Repository Sump	2002	Not Applicable	__	**F(S)**	**W**
SBGW-107T	1999	Till	**X**	__	**W**
SBGW-107	1999	Granite	**X**	__	__

Note: X Samples collected and analyzed for full suite of laboratory parameters
F Samples collected and monitored for field parameters only
(S) Repository Sump sample is collected only if water level data indicates that pumping of sump is needed (for this document, one annual pumping/sampling event is assumed to occur)
W Continuous water level monitoring
-- Indicates no monitoring.



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MW-1 Groundwater Monitoring Location

Sump

National Forest Boundary

Mine Waste Source Area

Unimproved Road

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Groundwater Monitoring Stations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 4

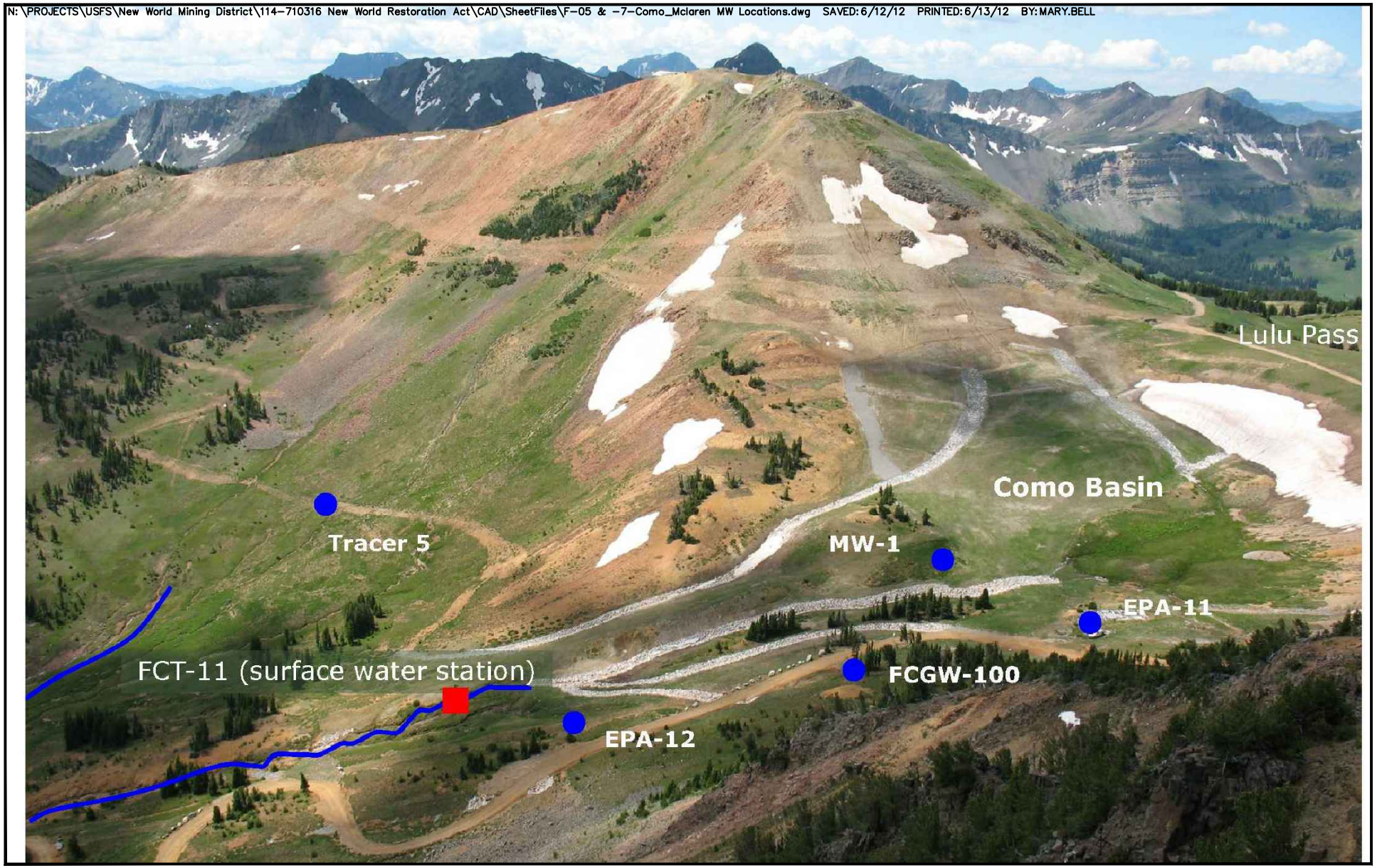
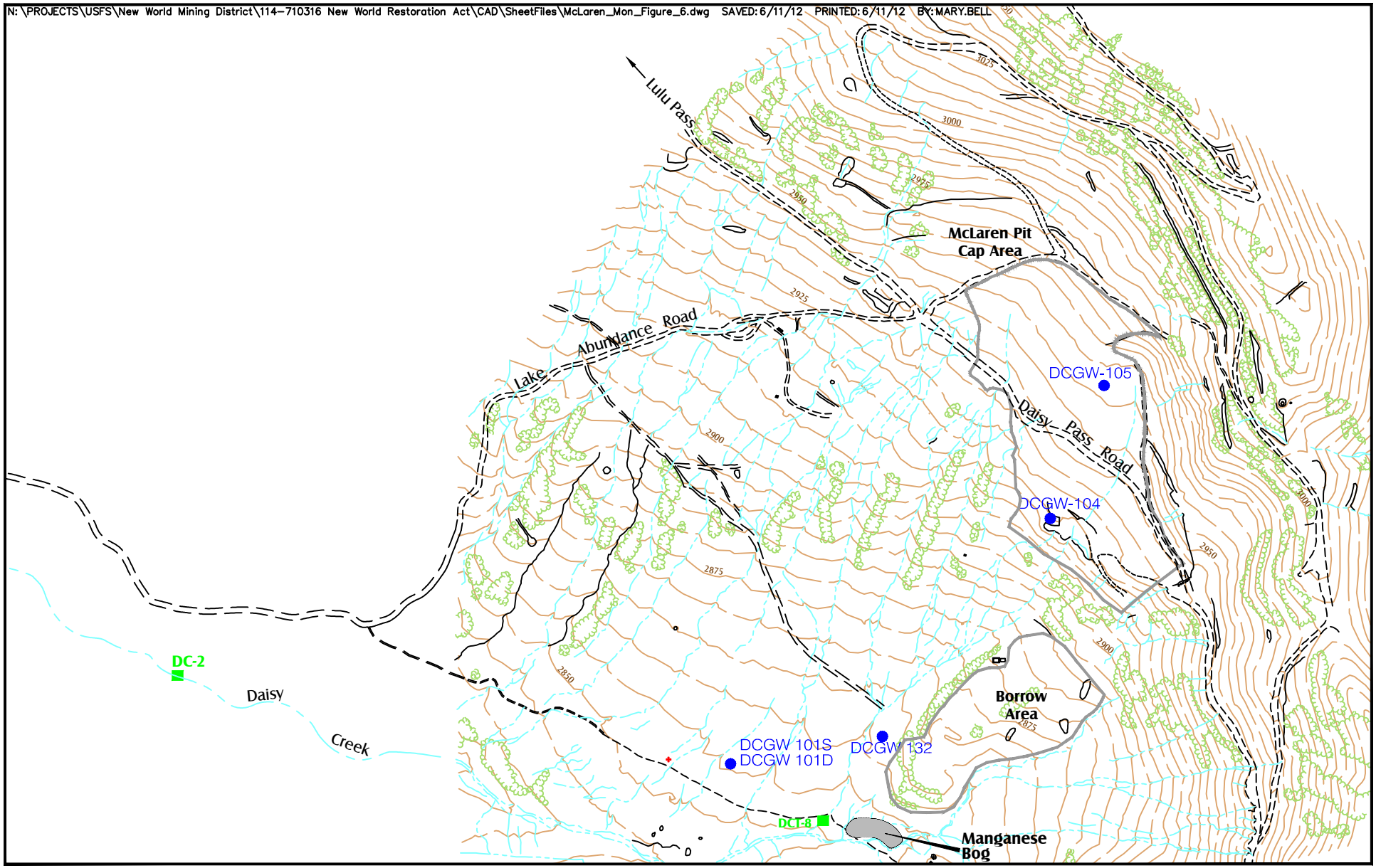


Photo of Como Basin Monitoring Well Locations Above Fisher Creek
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 5



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McLaren Pit Area Monitoring Stations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 6

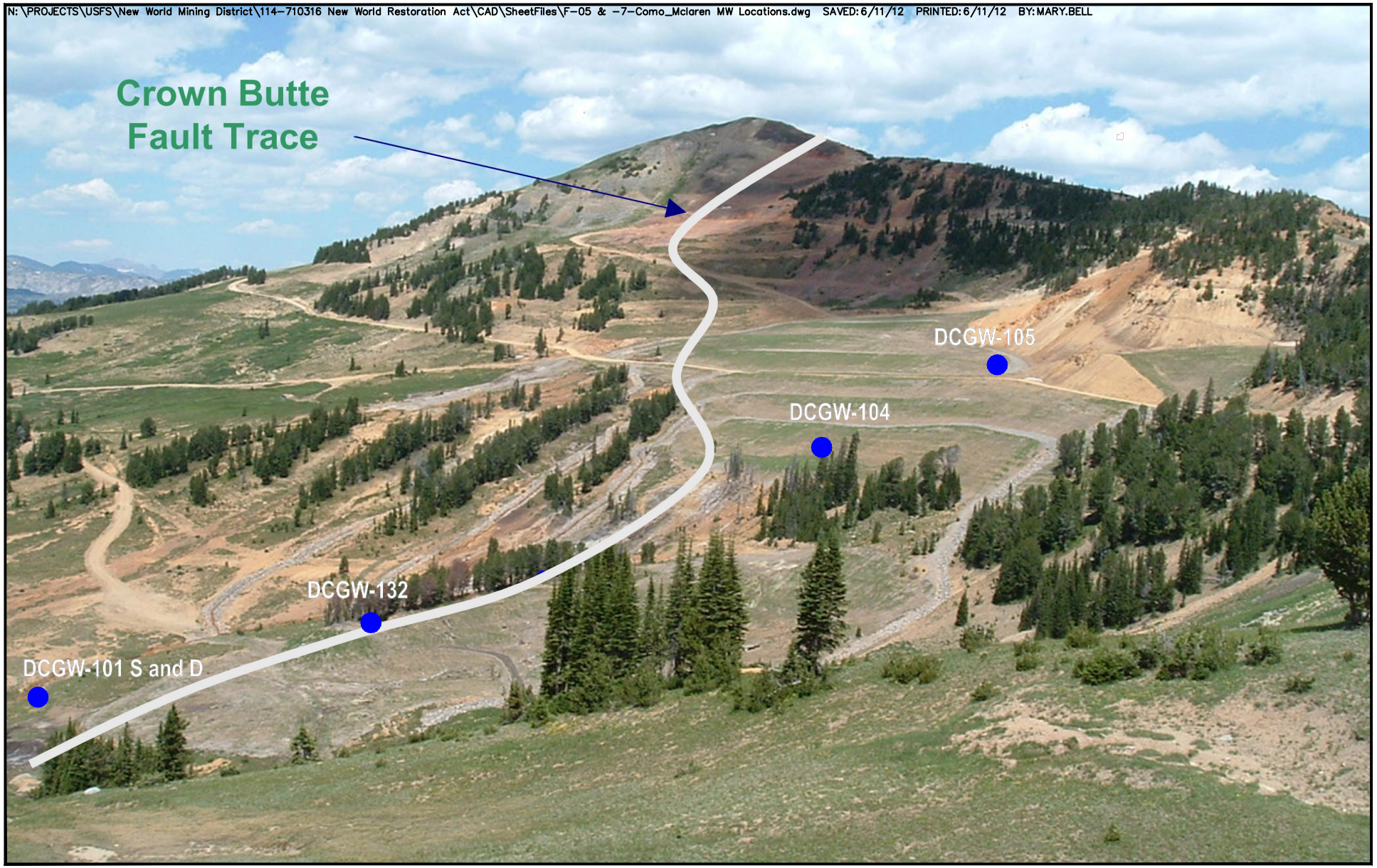

Photo of McLaren Pit Area Monitoring Well Locations
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
FIGURE 7

TABLE 6
GROUNDWATER FIELD PARAMETERS
Long-Term Operations and Maintenance Plan

Parameter	SOP Number[1]	SOP Title	Event
Specific Conductance	SOP-05	Field Measurement of Specific Conductance	All
pH	SOP-06	Field Measurement of pH	All
Water Temperature	SOP-07	Field Measurement of Water Temperature	All
Oxidation-Reduction	SOP-28	Field Measurement of Redox Potential (Eh)	All
Dissolved Oxygen	SOP-08	Field Measurement of Dissolved Oxygen	All
Depth to Water	SOP-20	Field Measurement of Groundwater Level	All

1 Maxim Standard Operating Procedures (Appendix A, Site-Wide SAP)

TABLE 7
GROUNDWATER SAMPLING REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	Preservation[1]	Bottle Size/Type
Dissolved Metals	Filtered through 0.45 micron filter; HNO3 to pH < 2; Iced to 4°C	250 milliliter polyethylene
Common Ions/Physicochemical	Iced to 4°C	500 milliliter polyethylene

1 HNO_3 = nitric acid

TABLE 8
GROUNDWATER ANALYTICAL REQUIREMENTS
Long-Term Operations and Maintenance Plan

Parameter	PQL (mg/l)[1]	EPA Method No.	Max. Holding Time
Physicochemical			
Specific Conductivity	None	2310B	28 days
pH	None	150.1	Upon arrival at lab
Total Dissolved Solids	None	2340C	7 days
Hardness	None	2340B	6 months
Acidity	None	305.1	14 days
Metals[2]			
Aluminum	0.05	200.8/200.7	6 months
Cadmium	0.0001	200.8/200.7	6 months
Copper	0.001	200.8/200.7	6 months
Iron	0.01	200.8/200.7	6 months
Lead	0.001	200.8/200.7	6 months
Manganese	0.003	200.8/200.7	6 months
Zinc	0.01	200.8/200.7	6 months
Common Cations[2]			
Calcium	1.0	200.8/200.7	6 months
Magnesium	1.0	200.8/200.7	6 months
Potassium	1.0	200.8/200.7	6 months
Sodium	1.0	200.8/200.7	6 months
Common Anions[2]			
Sulfate	None	375.2	28 Days
Bicarbonate	None	2320B	14 Days
Carbonate	None	2320B	14 Days
Chloride	None	325.3	28 Days

1 PQL = Practical Quantitation Limit in milligrams per liter (mg/L)
2 Groundwater parameters will be analyzed as dissolved constituents as filtered through a 0.45 micron filter

2.5 AQUATICS / BIOLOGICAL MONITORING

Aquatic data collection will be conducted to monitor the effects of surface water quality, flow, and streambed sediment on macroinvertabrate populations. This data will be used to evaluate trends in benthic community structure that might be attributable to improvement of conditions over time. Monitoring will be conducted at the seven surface water stations monitored for compliance with temporary water quality standards (**Table 1**). Monitoring will occur once annually during the first three year period of the operations and maintenance program (2013 through 2015). Data collected during this time will be compared to results of aquatics/biological monitoring data collected in 1999 and 2001. This proposed level of sampling is considered the minimum amount that would take place. An interagency aquatic group may convene to determine the appropriate level of sampling to be conducted after 2015.

Macroinvertabrate sample collection protocols and stream impairment ratings will be based on protocols similar to baseline collection protocols and protocols specific to the state of Montana using the DEQ's newest multimetric (MMI) protocols (MT DEQ 2005, Jessup et al. 2005, and Feldman 2006). Further analysis will be performed to calculate biotic integrity indices, ratios of scraper, shredder and filtering taxa, ratios of EPT and Chironomidae taxa, tolerance quotients, tolerance values, and community similarity indices. Other biotic metrics that are more sensitive to adverse chemistry may be calculated to determine more specifically how adverse water quality is causing impairment to project area streams.

Periphyton will be sampled by scraping and brushing a composite of algae from a variety of natural substrates lifted from the streambed. Samples will be placed in a cool, dark location as soon as practicable and shipped under similar conditions to a qualified laboratory. Laboratory analysis will be completed to assess relative amounts of primary productivity through the use of ash free dry mass and chlorophyll composition. Concentrations of the specific pigments chlorophyll a, b and c will be analyzed for using laboratory approved methods.

2.6 RECLAMATION MONITORING

Based on 2010 cover monitoring results, none of the reclamation areas are experiencing soil erosion that requires maintenance, possible reseeding, or additional fertilizer or erosion blanket installation (Tetra Tech 2011). Having consecutively sampled for 3 years, future reclamation monitoring will be conducted in accordance with monitoring procedures described in the Long-Term Revegetation Monitoring Plan (Maxim 1999e) as modified by the New World Revegetation Monitoring: Review and Recommendations Technical Memorandum (Tetra Tech 2009b).

Area-wide monitoring will be conducted at 5 year intervals with the first event scheduled for 2016. The purpose of monitoring is to determine if there are any erosion problems warranting attention or whether there are germination failures in areas greater than 250 square feet. Area-wide monitoring will also monitor for the presence of invasive plants. Monitoring success of whitebark pine tree plantings will also occur as necessary per the Overall Site Plan and Long-Term Revegetation Monitoring Plan (Maxim 1999e, 1999f) and in accordance with accepted practices.

If bare or eroded areas are observed during monitoring, soil samples will be collected for laboratory analysis. Samples will be collected from a depth interval of 0-15 cm and placed in one-gallon polyethylene bags. Samples will be labeled by location and returned to a qualified laboratory for selected analyses in accordance with the parameters and methods in the Site-Wide SAP for native soil collection. Laboratory parameters may include USDA soil texture, coarse fragment content, organic

matter, pH, electrical conductivity, nutrients, and total metals (aluminum, arsenic, cadmium, copper, lead, and zinc). Sample collection and parameter selection will be performed at the discretion of the field investigator to ensure site-specific conditions are being addressed. Following receipt of the laboratory analysis, recommendations will be made to amend soils or reseed barren areas.

2.7 MAINTENANCE AND EROSION CONTROL

It is anticipated that infrequent maintenance and erosion control measures will be implemented during the operations and maintenance period to correct rilling, slumping, or other erosion occurring on reclaimed areas in the District. Maintenance may also be required in response to changing site conditions related to fire, seismic events, or other unanticipated events. Such maintenance measures may include re-grading, ditch and culvert maintenance, re-seeding, and/or installation and maintenance of silt fences and erosion matting. Maintenance may also include installation of new monitoring wells, repair of old monitoring wells, and abandonment of wells no longer needed for the project. Refer to Appendix A for a list of previously abandoned monitoring wells. Work would also occur to address any other potential failures associated with reclamation work such as leaking adit plugs, compromised impermeable liners, etc. It is also likely that periodic entry into the manhole outside the McLaren Adit will be required to flush the seepage collection piping system with a high pressure hose. For purposes of cost estimating, it is assumed that such measures will be required once every three years.

2.8 PREPARE ANNUAL REPORTS

Two abbreviated project documents will be prepared annually during the long-term operations and maintenance period that include discussions of many of the items discussed in Section 2.0. These documents are summarized in **Table 9** along with a description of the document contents and approximate delivery schedule.

TABLE 9
PROJECT DOCUMENT LIST
Long-Term Operations and Maintenance Plan

Deliverable Title	Contents	Delivery Schedule
Annual Surface Water and Groundwater Monitoring Report	Results and analyses of ongoing surface water and groundwater monitoring	Every February through 2032
Annual Activities Report	Summary of project activities completed during the year, including reclamation monitoring results, and a summary of those to occur the following year.	Every February through 2032

2.9 AGENCY LIAISON

It is anticipated that a number of days will need to be devoted to agency liaison related issues. These issues would include such items as preliminary discussion of surface and groundwater quality data during preparation of annual monitoring reports and similar issues related to aquatics monitoring. Data and reports related to TMDL and temporary water quality standards review may also be prepared for presentation to DEQ, BER, Consent Decree participants, and other interested parties during meetings and groundwater control district discussions. These meetings / data collection activities will involve

both contractor and US Forest Service personnel coordination to produce various working documents and deliverables.

The budget for this task includes only contractor's costs. Forest Service costs are included in Task 2.10.

2.10 FOREST SERVICE COSTS

The Forest Service will have both administrative and other project oversight costs associated with the Site-Wide, Long-Term Operations and Maintenance Plan. It is envisioned that the On Scene Coordinator will conduct the work on the project, at a rate of approximately $500/day with travel costs of about $110/day. These costs are tabulated by task in **Table 10** below.

Table 10
US Forest Service Administrative and Project Oversight Costs

Tasks	Components	Labor	Travel	Total
Project Administration		$2,000	$330	$2,330
Annual Meeting	Preparation and attendance	$2,500	$220	$2,720
Database Management	Reply and respond to requests	$1,500	$ 0	$1,500
Water Quality Report	Review surface and groundwater annual reports	$3,000	$ 0	$3,000
Reclamation	Field inspections	$1,500	$330	$1,830
Implementation & Maintenance	10 days every three years or 3.3 days per year	$1,650	$330	$1,980
Agency Liaison		$4,000	$550	$4,550
Annual Report	Review annual report	$1,500	$ 0	$1,500
		Grand Total		**$19,410**

3.0 COST ESTIMATION

Costs for long-term operations and maintenance activities have been estimated and are provided in **Appendix B**.

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APPENDIX A

Well Abandonment

Fifty eight monitoring wells were identified for abandonment during the 2006 work season (**Figure A1**). Of these 58 wells, five could not be located in the field, 11 had water levels that were above the ground surface and required pressure grouting, and the remaining 42 wells were abandoned by filling the well casing with bentonite, cutting the casing off three feet below the ground surface, backfilling the disturbance and revegetating. **Table A1** lists each of these wells and the date and method used for abandonment.

NEWWORLD\cadpro\workplan\2005\all_well_locations_04_05.dwg

Source: Topographic data from USGS 7.5 Cooke City Quad
Contour Interval = 40'

N

0 Feet 2000
Scale 1:24,000

MAXIM TECHNOLOGIES 4560831.112

District Boundary
Forest Boundary
Roads

Groundwater Monitoring Well
Groundwater Monitoring Well Abandoned

Monitoring Wells Abandoned
New World Mining District
Response and Restoration Project
Cooke City Area, Montana
Figure A1

TABLE A1
2006 WELL ABANDONMENT PROGRESS LIST
NEW WORLD RESPONSE AND RESTORATION

Drainage	Well ID		Mine Coord	Mine Coord	Mine Elevation	Coordinates (State Plan NAD 83)			Location	Casing Diam. (in)	Approximate Cased Depth (ft below ground surface)	Well Screen (ft)	Well Protector		Water Measure Date	Depth to Water (fom TOC)	Casing Stickup	Water above or below GS	Needs pressure grouting? Yes/No	Field Observation	Date filled with bentonite chips	lbs bentonite used	Hydrated?	Date casings cut below grade and site restored
Fisher Ck	KP92	1	42831.38	61584.54	8797.74				Fisher Ck	1.5	35.5	25.5-35.5	4" steel		8/24/2006	6.8	2.5	below		50 ft W of Fisher Cr in trees along old access track, up from MW-4				9/29/2006
Fisher Ck	KP92	2	44900.67	57168.66	8902.32	89795.2	565872.3		Fisher Ck	1.5	43.8	33.8-43.8	4" steel		9/14/2006	3.4	1.9	below		Steel cap off	9/14/2006	32	yes	9/25/2006
Fisher Ck	KP92	4	43761.07	61221.74	8859.19	89442.6	567099.8		Fisher Ck	1.5	39.0	38.5-48.5	4" steel		8/23/2006	17.3	1.6	below		Up old track off Fisher Cr Rd. Track is 0.1 mile up from Goose Lake Rd	8/23/2006	20	yes	9/25/2006
Fisher Ck	KP92	5	44083.91	60308.71	8860.38	89541.92	566817.3		Fisher Ck	1.5	35.3	25.3-35.3	4" steel		8/23/2006	7.8	1.3	below			8/23/2006	25	yes	9/29/2006
Fisher Ck	KP92	6	44702.64	58848.41	8892.09	89734.1	566384.4		Fisher Ck											Cannot locate in field				
Fisher Ck	KP92	7	44715.75	58031.95	8705.13	89795.29	566135.3		Fisher Ck	1.5	38.5	28.5-38.5	4" steel	Artesian	8/23/2006	0.0	NM	--	YES	200 feet above Fisher Cr Rd via access track visible from road				9/28/2006
Fisher Ck	KP92	8	44611.37	57442.64	8894.73	89737.19	565978.8		Fisher Ck	1.5	51.0	41-51	4" steel		9/25/2006	2.2	1.2	below		On WEST side of Fisher Cr, can see from Fisher Cr Rd	9/25/2006	18	yes	9/25/2006
Fisher Ck	KP92	9	44254.85	58283.12	8872.12	89597.3	566156.4		Fisher Ck	1.5	50.0	41-51	4" steel		8/24/2006	4.4	2.2	below						9/28/2006
Fisher Ck	KP92	10	43564.77	58471.56	8953.69	89390.69	566264.4		Fisher Ck	1.5	94.5	74.5-94.5	4" steel		8/24/2006	+10		below		At end of track going uphill. Track is approx 480 ft downstream of SB-25				9/28/2006
Fisher Ck	KP92	11	44481.54	59504.18	8882.57				Fisher Ck	1.5	32.0	22-32	4" steel		8/23/2006	17.5	1.7	below			8/23/2006	22	yes	9/28/2006
Fisher Ck	KP92	12	43872.34	59344.71	8852.11	89484.16	566535.3		Fisher Ck	1.5	35.5	26.5-36.5	4" steel		9/14/2006	0.9	2.3	ABOVE	YES	Head down small road from SB-26				9/28/2006
Fisher Ck	KP92	13	43112.73	59702.55	8908.01				Fisher Ck	1.5	49.0	40-50	4" steel		8/24/2006	11.5	2.0	below		Head uphill in SE direction from wood debris pile (betw SB-26 and SB-27) into open area				9/28/2006
Fisher Ck	KP92	14	43251.84	60465.83	8848.81	89221.96	566834.2		Fisher Ck	1.5	37.0	27-37	4" steel		8/24/2006	5.3	2.2	below		Approx 250 ft downstream and 20 ft lower than SB-27				9/28/2006
Fisher Ck	KP92	15	41988.40	62045.23	8745.15	88908.36	567340.4		Fisher Ck	1.5	36.9	26.9-36.9	4" steel		9/14/2006	4.3	2.4	below			9/14/2006	28	yes	9/29/2006
Soda Butte	MW	12				86974.23	567566.1		1/4 mi W of Fisher Ck Rd	4	5.0	2.5-5.0	6" steel							Cannot locate in field				
Fisher Ck	SB	5	46113.22	55051.80	9010.1				Near MW-10	2	25.0	12-22	6" steel		8/23/2006	4.4	1.5	below		Track on right past MW-10A and 10B, off of Gold Dust road	8/23/2006	26	yes	9/26/2006
Fisher Ck	SB	9 B																		Cannot locate in field				
Fisher Ck	SB	9	46816.52	54679.72	9047.5				None given	2	20.5	13-20	NG	Artesian					YES					9/27/2006
Fisher Ck	SB	10 B							10' W of MW-10 -											Cannot locate in field				
Fisher Ck	SB	13	46352.99	54665.13	9068.4	90241.11	565112.9		Fisher Ck	1.5	99.0	70-99.5	6" steel		8/23/2006	9.9	2.4	below		Off track going to weather station from Gold Dust mine road, flagged	8/23/2006	65	yes	9/26/2006
Fisher Ck	SB	14	46624.89	54982.43	9056.2	90323.29	565212.2		Fisher Ck	1.5	100.0	85-99.5	6" steel		9/26/2006	9.3	2.3	below			9/26/2006	51	yes	9/26/2006
Fisher Ck	SB	14 A				90302.95	565229.9		Fisher Ck	2	45.3	25-45	4" steel		8/22/2006	13.1	2.5	below			8/22/2006	64	yes	9/26/2006
Fisher Ck	SB	14 B				90305.2	565189.4		8' NE of Bechtel's deep SB-14	2	71.5	56-71	4" steel		8/22/2006	11.9	2.2	below			8/22/2006	77	yes	9/26/2006
Fisher Ck	SB	15 A				90414.34	565345.5		Twinned with SB-15B Bechtel	2	37.0	12-37	4" steel		9/26/2006	17.5		below			9/26/2006	65	yes	9/26/2006
Fisher Ck	SB	15 (B)	46873.53	55358.39	9130.7	90401.24	565323.4		Fisher Ck	1.5	55.5	45.6-53.1	6" steel		9/26/2006	16.5		below			9/26/2006	32	yes	9/26/2006
Fisher Ck	SB	17 A				90415.35	565157.6		W of SB-14	2	30.0	15-30	4" steel		8/18/2006	15.3	1.9	below			8/18/2006	40	yes	9/26/2006
Fisher Ck	SB	17	46886.77	54903.80	9070.7	90404.75	565189.7		Fisher Ck	1.5	49.5	39.5-49.1	6" steel		8/18/2006	0.6	2.0	below			8/18/2006	30	yes	9/26/2006
Fisher Ck	SB	18	46732.04	56105.64	9195.5	90356.02	565548.1		Fisher Ck	1.5	48.0	27.3-46.5	6" steel	Artesian					YES	Turnoff at rock cairn, approx 300 ft below SB-14				9/27/2006
Fisher Ck	SB	19	47250.36	55443.93	9217.2	90514.34	565347.9		Fisher Ck	1.5	38.0	28.5-38.5	6" steel	Artesian					YES	Flagged through woods up old paths - start across from well SB-14				9/27/2006
Fisher Ck	SB	20	47866.87	54564.96	9230.7	90705.3	565086.9		Fisher Ck	1.5	49.0	29-48.6	4" steel		9/26/2006	20.7		below		E of Tredennic stream course above Fisher Cr road	9/26/2006	42	yes	9/26/2006
Fisher Ck	SB	21	48223.93	54020.61	9235.2	90814.93	564922.8		Fisher Ck	1.5	60.5	55-60	6" steel	Artesian					YES	Go up road approx. 300' from SW-3 st., then proceed uphill on old path approx. 300'				9/27/2006
Repository	SB	22	35960.03	64376.55	8169.8	87040.318	568049.4952	2492.25	SE of Repository	2	68.0	58.3-67.9	6" steel	Artesian					YES	Well protector is heavy gage steel casing				9/29/2006
Repository	SB	22 TS				87038.2658	568044.3602	2492.0787	SE of Repository	2	23.5	20.5-23.5	6' of 6" steel		8/23/2006	6.8	2.0	below			8/23/2006	21	yes	9/29/2006
Repository	SB	22 TD				87038.2658	568044.3602	2492.1242	SE of Repository	2	40.0	36-39	6' of 6" steel		8/23/2006	6.6	2.6	below			8/23/2006	50	yes	9/29/2006
Repository	SB	23	36593.85	64506.37	8252.1	87232.8052	568090.174	2517.2628	SE of Repository	2	70.5	50.7-70.3	6" steel		8/24/2006	8.9	2.6	below		Well protector is heavy gage steel casing		91	yes	9/30/2006
Repository	SB	23 TS				87225.7796	568092.3518	2517.2512	SE of Repository	2	8.0	6-9	6' of 6" steel		8/24/2006	7.2	2.0	below				11	yes	9/30/2006
Repository	SB	23 TD				87228.6375	568090.4857	2517.3823	SE of Repository	2	19.0	16-19	6' of 6" steel		8/24/2006	7.3	2.8	below				35	yes	9/30/2006
Repository	SB	24	35783.79	64645.47	8145.5	86986.769	568131.1882	2486.1071	SE of Repository	2	70.0	50-69.6	6" steel	Artesian	8/24/2006	0.6	2.0	ABOVE	YES	Well protector is heavy gage steel casing				9/30/2006
Repository	SB	24 T				86988.5467	568125.3697	2486.3698	SE of Repository	2	10.0	6-9	6' of 6" steel		8/24/2006	9.5	2.0	below						9/30/2006
Fisher Ck	SB	25	44090.00	58185.00	8720 NS				Fisher Ck	2	50.0	open end	6" steel	Artesian					YES	Visible from road on west side of Fisher Cr				9/28/2006
Fisher Ck	SB	26	43700.00	59110.00	8755 NS				Fisher Ck	2	60.0	open end	6" steel	Artesian					YES					9/28/2006
Fisher Ck	SB	27	43290.00	60145.00	8690 NS				Fisher Ck	2	68.0	open end	6" steel		8/24/2006	6.2	2.2	below		Continue on small road past wood debris pile				9/28/2006
Fisher Ck	SB	28	43440.00	61390.00	8810 NS				Fisher Ck	2	70.0	open end	NG							Cannot locate in field				
Repository	SB(GW)	101				87164.7862	567849.1789	2696.8306	S SE of Repository	2	100.0	92-102	6' of 6" steel	Artesian	9/14/2006	1.1	2.1	ABOVE	YES					9/30/2006
Repository	SB(GW)	101 TS				87160.0794	567843.4401		S SE of Repository	2	22.0	19-22	6' of 6" steel		8/24/2006	13.1	2.5	below			8/24/2006	30	yes	9/30/2006
Repository	SB(GW)	101 TD				87163.3731	567844.0073	2695.3896	S SE of Repository	2	33.0	29-33	6' of 6" steel		8/24/2006	11.5	1.7	below			8/24/2006	38	yes	9/30/2006
Repository	SB(GW)	101 TDD				87161.8165	567849.0346	2693.859	S SE of Repository	2	76.5	73.5-76.5	6' of 6" steel		8/24/2006	2.6	2.0	below						9/30/2006
Repository	SB(GW)	102				87015.8329	567878.326	2502.45	S SE of Repository	2	29.0	19.5-29.5	6' of 6" steel		9/14/2006	4.1	1.7	below			9/14/2006	39	yes	9/30/2006
Repository	SB(GW)	102 T				87019.7306	567884.6349	2502.627	S SE of Repository	2	8.0	5-10	6' of 6" steel		8/23/2006	7.9	2.4	below			8/23/2006	12	yes	9/30/2006
Repository	SB(GW)	103				87069.2003	568180.7927	2488.8189	S SE of Repository	2	50.0	40-50	6' of 6" steel		8/24/2006	1.8	2.0							9/29/2006
Repository	SB(GW)	103 TS				87068.4567	568173.2884	2489.3538	S SE of Repository	2	13.0	10-13	6' of 6" steel		8/24/2006	7.2	2.0	below				19	yes	9/29/2006
Repository	SB(GW)	103 TD				87070.3269	568176.4902	2489.3624	S SE of Repository	2	18.5	18-21	6' of 6" steel		8/24/2006	7.2	2.5	below				25	yes	9/29/2006
Fisher Ck	Tracer	7 (BC-12)				90527.03	564241.5		E flank Fisher Mtn.	3.5	49.0	--	none		9/28/2006	dry	1.7	below		Remote well	10/2/2006	70	yes	10/2/2006
Fisher Ck	FCGW	130				90527.03	564241.5		Upper Como Basin	2	9.0	4-9	6' of 6" steel		8/24/2006	dry	3.0	below			9/26/2006	15	yes	9/25/2006
Repository	WCW	1							Homestake & Lulu Rd Junction	2	16.0	--	none		9/28/2006	10.5	0.7	below		Observed white PVC pipes from roadside - NW well	10/2/2006	20	yes	10/2/2006
Repository	WCW	2							Homestake & Lulu Rd Junction	2	12.3	--	none		9/28/2006	10.6	1.7	below		Observed white PVC pipes from roadside - NE well	10/2/2006	17	yes	10/2/2006
Repository	WCW	3							Homestake & Lulu Rd Junction	2	19.4	--	none		9/28/2006	6.9	2.2	below		Observed white PVC pipes from roadside - SW Well	10/2/2006	26	yes	10/2/2006
Repository	WCW	4							Homestake & Lulu Rd Junction	2	11.2	--	none		9/28/2006	10.3	1.3	below		Observed white PVC pipes from roadside - SE well	10/2/2006	15	yes	10/2/2006

Notes: GS Ground Surface Artesian: Defined here as flowing well -- : Not determined

Well with groundwater level higher than ground surface and that required pressure grouting

Brown highlighting of fields indicates that well has been filled with bentonite, cut off approx. 3 feet below ground surface, backfilled, and site reclaimed

Blue highlighting of fields indicates that the well could not be located in the field

Summary:
Out of 58 wells scheduled for abandonment, five wells could not be located in the field and therefore, 53 were abandoned.
11 of these wells had water levels at or above ground surface during the time of abandonment in late September/October 2006
and therefore, had to be pressure grouted.

APPENDIX B

Cost Estimation

Costs for long-term operations and maintenance activities have been estimated and are shown for each year of the operations and maintenance period in **Table B1**.

Costs are estimated based on a number of assumptions including average annual inflation rate, discount rate, and frequency of certain operations and maintenance activities such as soil sampling during reclamation monitoring, reseeding, and replacement of culverts. These assumptions are explained in more detail below.

Average inflation rate was estimated using the data provided by Capital Professional Services (http://inflationdata.com/inflation/default.asp), particularly average inflation data by decade and long-term average data from 1913 through 2006 (http://inflationdata.com/inflation/images/charts/Articles/Decade_inflation_chart.htm). These data indicate that 3 % is a reasonable estimate for annual inflation for the operations and maintenance period from 2012 through 2032.

A discount rate of 5 % was used to calculate Net Present Value for purposes of estimating the amount of money that should be invested in order to cover costs during the 20 year operations and maintenance period. This reflects the historical Agency discount rate based on data from the US Office of Management and Budget and was adjusted downward to provide a more conservative net rate of return (discount rate minus inflation) of 2 %.

Costs associated with surface water and groundwater quality monitoring is based on the assumption that only the monitoring stations listed in **Tables 1** and **5** (see report text) would be monitored for the entirety of the operations and maintenance period. However, the decision to remove additional stations from the monitoring schedule may be warranted at some point. Surface water and groundwater quality data will be reviewed and Agency partners will be consulted to guide decisions on whether to continue monitoring at specific locations and/or times.

Costs associated with reclamation monitoring assume that site-wide area monitoring will occur every five years during the operations and maintenance period. The estimate also assumes that six soil samples will be collected and analyzed during each monitoring event.

Maintenance and erosion control costs were estimated assuming that such activities would occur once every three years. Material costs include cleaning ditches and culverts, regrading, re-seeding, erosion mat, and other miscellaneous items. Maintenance costs also include replacement of the continuous water-level meter installed in the repository sump however meters installed in other wells will only be replaced on a to-be-determined basis. These costs were amortized over all years of the operations and maintenance period.

TABLE B1
COST ESTIMATE
Long-Term Operations and Maintenance Plan

TASK	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
	Cost in Dollars																					
SUBTASK No. 1 - Project Administration	10,375	13,746	14,159	14,583	15,021	15,472	15,936	16,414	16,906	17,413	17,936	18,474	19,028	19,599	20,187	20,793	21,416	22,059	22,721	23,402	24,104	379,745
SUBTASK No. 2 - Public/Technical Meetings	3,881	3,998	4,118	4,241	4,369	4,500	4,635	4,774	4,917	5,064	5,216	5,373	5,534	5,700	5,871	6,047	6,229	6,415	6,608	6,806	7,010	111,307
SUBTASK No. 3 - Maintain Project Database	4,064	4,186	4,312	4,441	4,574	4,711	4,853	4,998	5,148	5,303	5,462	5,626	5,794	5,968	6,147	6,332	6,522	6,717	6,919	7,126	7,340	116,543
SUBTASK No. 4 – Surface Water and Groundwater Quality Monitoring																						
4A - Surface Water/Groundwater Quality Monitoring - July Event	18,567	19,124	19,698	20,289	20,898	21,525	22,170	22,835	23,520	24,226	24,953	25,701	26,472	27,267	28,085	28,927	29,795	30,689	31,609	32,558	33,535	532,443
4B - Surface Water Quality Monitoring - September/October Event (includes McLaren Pit)	10,383	10,695	11,016	11,346	11,687	12,037	12,398	12,770	13,154	13,548	13,955	14,373	14,804	15,249	15,706	16,177	16,662	17,162	17,677	18,208	18,754	297,762
4C - Surface Water/Groundwater Monitoring Report	8,077	8,319	8,569	8,826	9,091	9,364	9,645	9,934	10,232	10,539	10,855	11,181	11,516	11,862	12,217	12,584	12,961	13,350	13,751	14,163	14,588	231,624
4D - Repository Pumping	11,000	11,330	11,670	12,020	12,381	12,752	13,135	13,529	13,934	14,353	14,783	15,227	15,683	16,154	16,638	17,138	17,652	18,181	18,727	19,289	19,867	315,441
SUBTASK No. 5 – Aquatics/Biological Monitoring	0	15,055	15,507	15,972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46,533
SUBTASK No. 6 - Reclamation Monitoring (includes soil analysis)	0	0	0	0	13,428	0	0	0	0	15,567	0	0	0	0	18,047	0	0	0	0	20,921	0	67,963
SUBTASK No. 7 - Maintenance and erosion control (includes data-logger replacement, seed, culvert, and erosion mat, etc)	7,613	7,787	7,967	8,152	8,342	8,538	8,741	8,949	9,163	9,384	9,612	9,846	10,087	10,336	10,592	10,856	11,128	11,407	11,696	11,993	12,298	204,487
SUBTASK No. 8 - Annual Reporting (work plan/work completed)	5,694	5,865	6,041	6,222	6,409	6,601	6,799	7,003	7,213	7,430	7,653	7,882	8,119	8,362	8,613	8,871	9,138	9,412	9,694	9,985	10,284	163,290
SUBTASK No. 9 –Agency Liaison	8,014	8,254	8,502	8,757	9,020	9,290	9,569	9,856	10,152	10,456	10,770	11,093	11,426	11,769	12,122	12,485	12,860	13,246	13,643	14,052	14,474	229,811
SUBTASK No. 10- US Forest Service Administrative Costs	19,410	19,992	20,592	21,210	21,846	22,502	23,177	23,872	24,588	25,326	26,085	26,868	27,674	28,504	29,359	30,240	31,147	32,082	33,044	34,036	35,057	556,611
Sub Total *Annual*	107,080	128,353	132,149	136,060	137,065	127,292	131,056	134,934	138,928	158,609	147,279	151,644	156,139	160,769	183,585	170,450	175,510	180,721	186,089	212,538	197,312	
Cumulative	107,080	235,432	367,582	503,641	640,706	767,998	899,054	1,033,988	1,172,917	1,331,526	1,478,805	1,630,449	1,786,587	1,947,357	2,130,941	2,301,392	2,476,901	2,657,623	2,843,711	3,056,250	3,253,562	3,253,562
Net Present Value	101,981	218,400	332,556	444,492	551,886	646,873	740,013	831,341	920,896	1,018,268	1,104,379	1,188,820	1,271,624	1,352,823	1,441,131	1,519,216	1,595,790	1,670,883	1,744,525	1,824,629	1,895,452	1,895,452